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Isolated Nerve Grafting for a Young Patient with a Complete Common Peroneal Nerve Palsy Following a Traumatic Knee Dislocation: A case report

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Background: Common peroneal nerve (CPN) injury following a knee dislocation is a serious problem, and an optimal treatment is yet to be established. We report a case of complete CPN palsy following a knee dislocation treated with sural nerve grafting. Case: A 19-year-old man suffered a knee injury during a hurdle race. Diagnosis in a previous hospital revealed a complex ligament injury with CPN palsy. Ten weeks following injury, he was admitted to our institution because of a lack of neurological improvement. Considering the grade 0 results obtained in the manual muscle test (MMT) of tibialis anterior (TA) and extensor hallucis longus (EHL), the patient was diagnosed with complete neurotmesis of CPN, and surgery was performed. Operative findings revealed CPN discontinuity and an extended nerve defect length of 15 cm; therefore, sural nerve grafting was performed to repair the CPN injury. One year postoperatively, a grade 1 result from MMT of TA and EHL indicated a gradual neurological recovery. Three years postoperatively, MMT of TA and EHL showed significant improvement to grade 4+ and grade 4, respectively, and he could walk and jog without a knee brace. Discussion: Nerve graft length of >6 cm has shown limited success, and their efficacy for the treatment of CPN palsy following knee dislocations is controversial. However, young patients with complete CPN lesion are more likely to recover regardless of the length of nerve injury. Therefore, in such cases, nerve grafting can be considered as one of the treatments for complete CPN lesion following knee dislocations.

INTRODUCTION

Knee dislocations are rare but can cause severe complications. High- and low-energy traumas such as those due to traffic accidents and sports injuries [1], respectively, are the most common causes of knee dislocations. It has been reported that 5%–40% of patients with knee dislocations are complicated by common peroneal nerve (CPN) palsy to a certain extent [2]. The recovery rate of CPN palsy remains poor, and the presence of persistent foot drop shows significantly worse functional outcomes [3]. Despite various treatment options such as simple observation, neurolysis, direct nerve repair, nerve grafting, nerve transfer, and posterior tibial tendon transfer, an optimal treatment for CPN palsy following knee dislocations is yet to be well established. In this study, we report a case of complete CPN palsy following a knee dislocation treated with sural nerve grafting and its functional outcome.

CLINICAL CASE

Case presentation

The patient was a 19-year-old man who suffered a right knee injury during a hurdle race. Upon admission to a local hospital, he was diagnosed with complex knee ligament injury and CPN palsy. Bracing was performed as an initial treatment followed by electromyography (EMG) 2 and 4 weeks after injury. EMG revealed that neither nerve action potentials nor palsy of the patient showed any improvement. Therefore, 10 weeks following injury, he was admitted to our hospital for further treatment. There was no swelling and effusion on his right knee, and the range of motion was from 0° of extension to 130° of flexion. Furthermore, he showed severe instability under varus stress. In addition, Lachman and posterior drawer tests were positive; and the manual muscle test (MMT) grade of tibialis anterior (TA) and extensor hallucis longus (EHL) was 0.

Plain radiographs and computerized tomography images of his right knee taken by the previous hospital revealed no obvious fracture and dislocation (Fig.1), but magnetic resonance imaging revealed a lateral collateral ligament (LCL) rupture, posterolateral corner (PLC) injury, bone bruise in the medial condyle, anterior cruciate ligament (ACL), and posterior cruciate ligament injury (Fig.2).

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A nerve conduction study revealed that stimulation of CPN did not evoke compound muscle action potential of TA and peroneal muscle and sensory nerve action potential of the superficial peroneal nerve. Furthermore, needle electromyography revealed that TA, EHL, extensor digitorum longs, and peroneal brevis showed positive sharp waves in the rest position; however, the number of motor unit potential (MUP) during maximum voluntary contraction showed no reaction. Taking these findings into consideration, the patient was diagnosed with neurotomesis, with a surgical intervention at 3 months post injury.

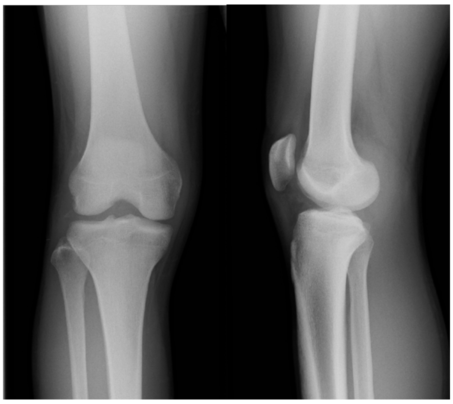

Fig. 1
Plain radiographs of his right knee taken by previous hospital showed no obvious fracture and dislocation.

Fig. 2
MRI demonstrated lateral collateral ligament (LCL) rupture, posterolateral corner (PLC) injury, bone bruise in the medial condyle, anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) injury.

Operation findings

Surgery was performed in the prone position, and an S-shape skin incision was made from the middle of the posterior thigh to the fibula head. CPN was detected at the medial to the femoral biceps tendon and found to be reddish and swollen. At the level of the knee joint line and near to the LCL, severe adhesion and scarring of the peroneal nerve were observed, and nerve trunk discontinuity was confirmed. Because the damaged length of the nerve was approximately 15 cm, nerve grafting was performed. From a graft donor, we harvested a 30-cm long sural nerve from the opposite site and divided it into two as a cable graft. Under a surgical microscope, we performed suturing of the perineurium using 7-0 nylon sutures and reinforced the suture site with fibrin glue. After skin closure, splint fixation was performed for 3 weeks.

Postoperative course

Six months postoperatively, Tinel's sign extended to the distal site, and MUP of the peroneal brevis was recorded using needle electromyography. Ten months after nerve grafting, ACL reconstruction with bone-patellar tendon-bone autograft and PLC reconstruction with semitendinosus tendon were performed for the treatment of knee instability. Furthermore, 2 years postoperatively, MMT of TA improved to grade 3, and the patient could walk without a knee brace. At the last follow-up 3 years postoperatively, MMT of TA showed significant improvement to grade 4+ and that of EHL to grade 4. Moreover, sensory disturbance of the superficial and deep peroneal nerve areas improved to 80% and 30%, respectively. Eventually, he could walk, jog, and run for a short distance.

DISCUSSION

The treatment of CPN palsy following knee dislocations is challenging. The most important predictor is whether CPN palsy is complete or incomplete at presentation. A comparison between the outcomes of partial and complete CPN palsy performed by Krych et al. showed that the recovery rates of incomplete and complete CPN palsy were 83% and 38%, respectively [4]. The outcome of incomplete CPN palsy was relatively good; therefore, a simple observation was recommended [5]. However, complete CPN palsy showed a relatively poor outcome; therefore, an optimal treatment algorithm has not been established.

Kim et al. reported that neurolysis resulted in a favorable outcome with a recovery rate of 75%; however, incomplete CPN palsy constituted majority of their cases [6]. However, Peskun et al. [7] and Owens et al. [8] demonstrated that there was no evident difference in nerve recovery rates with and without neurolysis. Although the efficacy of neurolysis remains unknown, it would be appropriate to perform neurolysis in patients with PLC injury with complete CPN palsy because the surgical site for reconstruction of PLC injury is near the CPN; furthermore, iatrogenic CPN injuries could be prevented and the status of CPN could be directly confirmed.

In case of neurotomesis, nerve grafting serves as a representative treatment option. Reportedly, the surgical outcome relies on the nerve graft length. Kim et al. reported that nerve grafting for patients with CPN palsy resulted in a functional recovery rate of 75% for <6-cm long grafts, 38% for 6–12-cm long grafts, and 16% for 13–24-cm long grafts [9]. In addition, Cho D et al. demonstrated that > 6 cm long grafts show a limited success rate [10]. Further, the length of nerve injury following knee dislocations can exceed 15 cm [11]. The efficacy of nerve grafting for CPN palsy following knee dislocations is controversial, but it seems to be a good indication where the length of nerve injury is <6 cm, as evidenced by findings of ultrasound and surgery. In this study, the defect length was 15 cm, which was considerably long; however, surgical outcome was good because of the patient's age. Niall et al. reported [12] that age also serves as a predictive factor for functional CPN recovery. Young patients are more likely to recover from complete CPN palsy regardless of the length of nerve injury. Therefore, in such cases, nerve grafting should be considered as an efficient treatment for complete CPN palsy following knee dislocations.

In addition to nerve grafting, nerve transfer and posterior tibial tendon transfer (PTTT) serve as alternative treatment options. Studies on the outcome of nerve transfer for CPN are limited [13]. PTTT is a salvage procedure for drop foot including CPN palsy. Although patients have relative weakness in dorsal flexion and a risk of mid-foot collapse and arthritis, 83% of patients achieved an excellent or good result with respect to patient satisfaction scoring [14]. In addition, Molund et al. reported that in 12 patients with CPN palsy following knee dislocation, isolated PTTT helped in regaining their ability to dorsiflex with a strength of 42% and a range of motion of 72% compared with those in the unaffected side [15]. Garozzo et al. showed that a combination of nerve graft and PTTT enhanced neurological and functional recovery rates to 68% [16]; however, dorsiflexion recovery rate was similar to that obtained using PTTT. Therefore, PTTT may serve as an efficient salvage procedure for patients with no neurological recovery from CPN palsy; however, further studies on PTTT for CPN following knee dislocations are required.

This case report has a limitation that any surgical intervention was not performed until 3 months after injury, because the patient come to our hospital 10 weeks following injury. It is still controversial about early exploration and decompression of complete nerve lesion, however, our operative findings revealed the discontinuity of the peroneal nerve trunk, so there was a possibility to get better outcomes by performing nerve grafting earlier.

CONCLUSION

Complete CPN lesion in a young patient may recover regardless of the length of the nerve injury. Thus, nerve grafting can be considered as a treatment option for complete CPN lesion following knee dislocations.

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